

REMARKS

Reconsideration of the present application is respectfully requested. Claims 2, 3, 8, 9, 18, 20 and 25 have been canceled. Claims 1, 4, 7, 13, 14, 17, 21 and 24 have been amended. No new matter has been added.

Claim Rejections

Claims 3, 9, 14 and 20 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1, 2, 5-8, 11-13, 15-18 and 22-25 stand rejected under 35 U.S.C. § 102(b) based on U.S. Patent no. 6,308,282 of Galipeau et al. ("Galipeau"). Claims 3, 4, 9, 10, 14 and 19-21 stand rejected under 35 U.S.C. § 103(a) based on Galipeau in view of U.S. Patent Application Publication no. 2003/0014433 of Teloh et al. ("Teloh").

Section 112 Rejections

Claims 3, 9 and 20 have been canceled. Claim 14 has been amended in a way that Applicants believe overcomes the rejection. Therefore, all of the rejections under section 112 are believed to have been overcome.

Prior Art Rejections

Before discussing the cited art, a brief overview of the invention may be helpful. The present invention relates to a data mirroring system that includes a source storage server which has a persistent data storage facility (e.g., a RAID group) and a destination storage server which has its own persistent data storage facility (e.g., another RAID group). The present invention is directed to a specific type of mirroring system that operates based on regularly occurring events called "consistency points".

Write requests received by the source storage server from clients are logged and transmitted to the destination storage server, where they are saved in a file associated with the

source storage server. However, the write requests are not immediately applied to data in persistent storage by either the source or destination storage server. Instead, write requests are applied to persistent storage only at consistency points (which occur regularly), at both the source storage server and the destination storage server.

At each consistency point, all write requests accumulated since the previous consistency point are applied to persistent storage at the source storage server, and the mirror copy of data at the remote storage server is also brought into synchronization with the primary copy at the source storage server at this time; this is known as consistency point synchronization, or “CP sync”. This happens at each consistency point, which may occur, for example, every few seconds during normal operation (depending on the particular system configuration).

Also, in accordance with the invention, the source storage server sends file system generated volume block number updates to the destination storage server during the synchronization phase of the consistency point. The destination storage server then uses those volume block number updates to update its mirror copy of the data via its own RAID layer. This is in contrast with certain prior systems in which the source storage server’s RAID layer sent updates directly to the disks owned by the destination storage server (i.e., disk block number updates, not volume block number updates), bypassing the file system and RAID layer in the destination storage server. See generally Applicants’ specification at paragraphs [0011] – [0013] and Fig. 4.

Referring now to the claims, claim 1, as amended, recites:

1. A method of operating a destination storage server to mirror a primary volume maintained by a source storage server, the method comprising:
 - receiving, at the destination storage server, a plurality of log entries from the source storage server, the plurality of log entries representing write requests received by the source storage server;
 - writing the received log entries to a file maintained by the destination storage server;
 - receiving, at the destination storage server, data from the source storage server **during a synchronization phase of a consistency point, the**

consistency point being one of a plurality of regularly occurring consistency points, each characterized by the saving of data specified by write requests in a set of non-volatile storage devices managed by a RAID layer in the source storage server and in a set of non-volatile storage devices managed by a RAID layer in the destination storage server, wherein said data received at the destination storage server from the source storage server during the synchronization phase of the consistency point include **volume block number updates** from the source storage server; using the data received at the destination storage server from the source storage server during the synchronization phase of the consistency point, **including the volume block number updates**, to update a mirror volume maintained by the destination storage server, via the RAID layer in the destination storage server; and using log entries from the file to update the mirror volume. (Emphasis added.)

Each of Applicants' independent claims has been amended essentially to recite the limitations emphasized above in bold.

The cited references do not disclose or suggest such a method, either individually or in combination. Galipeau, for example, discloses a completely different type of mirroring approach, which is not based on consistency points. In the system of Galipeau, a local computer system 1 stores received write requests in a Store and Forward log (col. 8, lines 4-44). The requests are then forwarded from the local computer system 1 to a remote computer system 5. At the remote system 5, the forwarded log entries are received and stored in a request log, which is subsequently used by a router process 53 to update a backup copy of data at the remote computer system 5 (col. 3, lines 21-40; col. 9, lines 16-41). There is no disclosure or suggestion, however, of any regularly occurring synchronization between the times when write requests are applied to disk in the local system 1 and the times when write requests are applied to disk in the remote system 5.

The system of Galipeau is not based on, and does not use, consistency points such as defined in Applicants' claims, i.e., where a consistency point is one of a plurality of regularly occurring events, each characterized by the saving of data specified by write requests in a set of non-volatile storage devices managed by a RAID layer in the source storage server and in a set

of non-volatile storage devices managed by a RAID layer in the destination storage server, and during a synchronization phase of which the destination storage server receives data from the source storage server. In Galipeau there are no regularly occurring consistency points as defined in Applicants' claims, and as such, there is no disclosure of any synchronization phase of such an event, as recited in claim 1.

Galipeau does disclose that a send process 50 in the local computer 1 reads the Store and Forward Log entries periodically, e.g., every tenth of a second (col. 7, lines 56-61). However, that activity is not part of a "consistency point" as defined in Applicants' claims, since it is not tied to the action of saving data to disk (Galipeau explicitly states that the send process 50 executes "in the background (i.e., asynchronously from other software . . .)"). In addition, the router process 53 on the remote system 5 uses received log entries to update the backup copy on disk at a time which is not tied to saving data on disk at the local computer 1 (col. 9, lines 16-41). In Galipeau there is no disclosure of any explicit synchronization between the times when recently received writes are saved to disk on the local and remote computer systems 1 and 5, respectively, unless a user explicitly sends a synchronization command (col. 9, line 54-56), which is not a regularly occurring event.

In addition, Applicants do not find any disclosure or suggestion in Galipeau that a destination storage server (e.g., remote system 5) receives, during a consistency point, volume block number updates from a source storage server.

Likewise, Applicants also do not find any disclosure or suggestion of these claim features in Teloh either.

For at least these reasons, therefore, each of Applicants' independent claims is patentable over the cited art along with its dependent claims.

Claims 7 and 13

In addition, each of independent claims 7 and 13 further recites that the write requests

received by the destination storage server are stored in a file which is associated with the source storage server, or similar language. The cited art does not disclose or suggest such functionality. In Galipeau, for example, write requests are received by the remote computer system 5 and logged in a request log in the remote computer system 5 (col. 3, lines 21-40); however, there is no suggestion that the request log is in some way associated with any particular local computer system 1 or any computer system other than the remote computer system 5 in which it is maintained. For this additional reason, therefore, claims 7 and 13 are further patentable over the cited art along with all of their dependent claims.

Dependent Claims

In view of the above remarks, a specific discussion of the dependent claims is considered to be unnecessary. Therefore, Applicants' silence regarding any dependent claim is not to be interpreted as agreement with, or acquiescence to, the rejection of such claim or as waiving any argument regarding that claim.

Conclusion

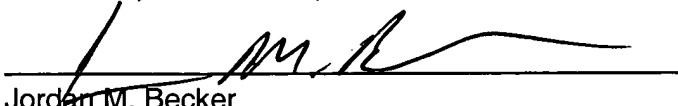
For the foregoing reasons, the present application is believed to be in condition for allowance, and such action is earnestly requested.

If there are any additional charges/credits, please charge/credit our deposit account no. 02-2666.

Respectfully submitted,

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